Zircon Geochronology of Indiana Till as an Indicator of Provenance

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Approximately 23,000 yrs. ago, during the Wisconsin glacial advance, three ice lobes from the Laurentide ice sheet originating in Canada flowed into Indiana. The Lake Michigan lobe entered from the north, the Erie lobe from the northeast, and the Saginaw lobe in between. The distribution of deposits from the lobes is easily discernable in some locations where the land has been molded into moraines, but in other locations, the ice sheet history is uncertain. We investigate whether the age spectra of sand-sized zircon minerals in the glacial deposits can be used as a reliable tracer of glacial ice lobe movement when the direction of ice flow is ambiguous. Glacial till samples from Lake Michigan, Saginaw, and Erie lobe tills and one sample from a till of unknown origin were analyzed using zircon geochronology. Because the upstream bedrock has distinctly different ages it was hypothesized that the samples would reflect that by having different ages. A total of 450 grains were analyzed via MC-LAICPMS and zircon ages range from ~4.05-3.11 Ga (billion years). Surprisingly all 4 samples have broadly similar distributions with dominant Grenville-aged populations (1-1.3 Ga), and smaller Superior-aged peaks (2.55-2.8 Ga). Statistical tests indicate that the unknown, Erie, and Saginaw samples were derived from different populations, but that the unknown and Lake Michigan sample may have a similar source (95% confidence). Because there is a strong similarity in the distribution of ages between the four samples and a simple explanation cannot be reached connecting the unknown sample to one of the known ice lobes, more work is needed to assess whether this methodology could be successfully used in the Midwest as an indicator of till provenance. Other factors such as eroded sedimentary rocks in the Michigan basin and reworking of older tills may need to be taken into consideration.

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